


Variable Adjustment of Resistance in Magnetic Sensor Using Nanothin Layer

adjustable resistance semiconductor devices for magnetic disk storage devices

Nanoscale blasting adjusts resistance in magnetic sensors with up to three orders of magnitude control.

Annual Sales Forecast for USA * 				Innovation Status		Idea
Sales & Marketing Support Level	Conservative 80% odds of selling	Most Likely 50% odds of selling	Aggressive 20% odds of selling	Development Status	Proprietary Protection Status	Concept Score
Ultra Low	\$0	\$5,100	\$53,000	1 of 5 In Development	2 of 5 Patent Pending	30 29 is Average
Low Support	\$67,000	\$220,000	\$620,000			
Medium Support	\$570,000	\$1.6 M	\$3.8 M			
High Support	\$1.5 M	\$4.4 M	\$10.4 M	Remaining Time & Cost to First Sale		
Ultra High	\$2.9 M	\$8.2 M	\$19.2 M	6 mos-1 yr	\$10k-\$100k	

Variable Adjustment of Resistance in Magnetic Sensor Using Nanothin Layer - *adjustable resistance semiconductor devices for magnetic disk storage devices*

Final Decision Maker: *MRAM manufacturers, magnetic sensor manufacturers*

A new process for adjusting the resistance of semiconductor devices by carpeting a small area of the device with tiny pits, like a yard dug up by demented terriers, may be the key to a new class of magnetic sensors, enabling new, ultra- dense data storage devices. The technique demonstrated by researchers at the National Institute of Standards and Technology (NIST) allows engineers to tailor the electrical resistance of individual layers in a device by altering only a single step in the fabrication process- an important consideration for future scale- up- and can be applied to any device where it's desirable to fine- tune the resistance of individual layers.

As manufacturers strive to make disk storage devices smaller and more densely packed with data, the sensors need to shrink as well. To meet the size constraints, prototype sensors measure sensor resistance perpendicular to the thin layers, but depending on the buffer material in the sensor, two different types of sensors can be made. Giant magneto- resistance (GMR) sensors use a low- resistance metal buffer layer and are fast, but plagued by very low, difficult to detect, signals. On the other hand, magnetic tunnel junction (MTJ) sensors use a relatively high- resistance insulating buffer that delivers a strong signal, but has a slower response time, too slow to keep up with a very high- speed, high- capacity drive.

The NIST approach is to combine these at the nanometer scale. Starting with a magnetic tunnel junction- an insulating buffer- and then, using highly charged ions, little pits are blown into the buffer layer so that when the rest of the sensor is grown on top, the pits will act like little GMR sensors, while the rest will act like an MTJ sensor. The combined signal of the two effects should be superior to either alone. The NIST team has demonstrated the first step- the controlled pockmarking of an insulating layer in a multi- layer structure to adjust its total resistance. NIST researchers now are working to incorporate these modified layers into working magnetic sensors.

\$25 for 4 MB chip

Seeking: *Purchase, Investment, Manufacturing/ R&D*

 **Email Inventor(s)**

 **Link to Website With More Info**

 **Link to YouTube Video**

 **Inventor(s) Open to Consulting Requests**

 **Agree to use Fair Contract**

 **Invention can be exported**

* Consumption sales forecast. Does not include "Random" events or ☐Inventory Fill☐. Forecast is for Year 1 for Large or Year 2 for Small Companies. Forecast should be read as ...☐With Low marketing support there is an 80% odds of achieving sales of at least...

Listing #: USA.75.032709.033

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Report Assumptions and Inventor(s) Commentary

Inventor(s) Assumptions	"Most Likely" Estimate	Confidence	Inventor(s) Commentary Data Source or Basis for Assumptions
# of Possible Final Decision Makers	2,000	20%	based on number of profitable semiconductor device manufacturers in US
Revenue per First Purchase	\$25,000.00	20%	As a first trial, a manufacturer may want 1000 units to work with before committing to future purchases.
% that will Repeat	40%	20%	This is a revolutionary technology that would enable MRAM to take off in a very big way. There are many things that could positively or negatively impact its adoption.
Number of Annual Repeats	3	20%	the size of the possible markets (memory storage for automobiles) would be vast.
Revenue per Repeat Purchase	\$25,000.00	20%	this is uncharted territory and MRAM could take off well beyond the optimistic estimates here
Reseller (Trade) Margin	N.A.	N.A.	
Producer Profit (EBITD)	14%	20%	based on industry stats

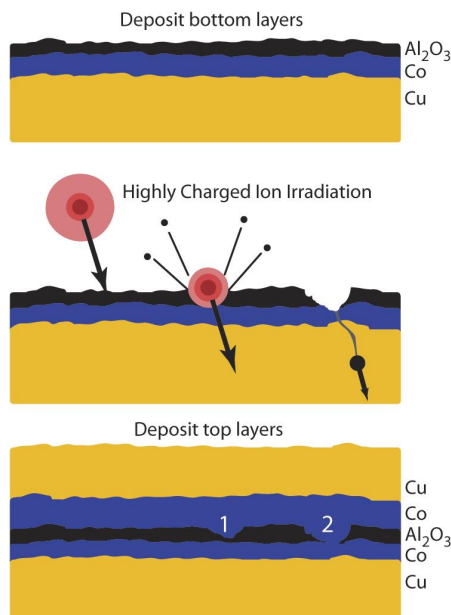
Innovation Status			
Development Status	1 of 5 In Development		NIST demonstrated controlled pockmarking of insulating layer in multi-layer structure to adjust total resistance and now incorporating modified layers into working magnetic sensors
Cost to First Sale (remaining)	\$10k-\$100k	20%	this estimate assumes that a semiconductor manufacturing line is already in place
Time to First Sale (remaining)	6 mos-1 yr	20%	some additional testing is required for specific end uses
Confidence in Concept Claims made in description		20%	first step has been demonstrated and modeling in magnetic sensors is promising
Proprietary Protection Status	2 of 5 Patent Pending		NIST filed a provisional patent on the work, US #60,905,125

Concept Score & Diagnostics						
<div></div> <div>Merwyn Concept Score With Confidence Bands</div>			Concept Diagnostics	Red	Yellow	Green
			Percentile Group	Bottom 40%	Middle 40%	Top 20%
Pessimistic 80% odds of at Least	Most Likely 50% odds of at Least	Optimistic 20% odds of at Least	Overt Benefit			
			Reason to Believe			
21%	30%	39%	Dramatic Difference			

Inventor Commentary & Alternative Development Scenarios

Inventor(s) Sales Goals

Minimum Goal	\$10,000	Current GOAL	\$25,000
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(Top) First layer, eg Cu and Co, with insulating buffer layer of ~1nm Al₂O₃. (Mid) Highly charged Xe +44 ions strike buffer, digging nanoscale pits. (Bottom) Top layer of Cu and Co

Inventor(s) Commentary:

There are currently two large companies manufacturing and selling MRAM. The market at the moment appears to be applications like automotive memory (for computes in cars), some satellite, industrial machines, etc. where very large volumes of memory are not required but robustness and energy efficiency may be important.

CURRENT SALES FORECAST

Sales & Marketing Support Level	Conservative 80% odds of selling	Most Likely 50% odds of selling	Aggressive 20% odds of selling
Ultra Low	\$0	\$5,100	\$53,000
Low Support	\$67,000	\$220,000	\$620,000
Medium Support	\$570,000	\$1.6 M	\$3.8 M
High Support	\$1.5 M	\$4.4 M	\$10.4 M
Ultra High	\$2.9 M	\$8.2 M	\$19.2 M

If MARKETING CONCEPT Improved

(Increase Concept Score by +20 Points)

Sales & Marketing Support Level	Conservative 80% odds of selling	Most Likely 50% odds of selling	Aggressive 20% odds of selling
Ultra Low	\$0	\$8,800	\$91,000
Low Support	\$120,000	\$380,000	\$1.0 M
Medium Support	\$990,000	\$2.7 M	\$6.5 M
High Support	\$2.8 M	\$7.5 M	\$17.4 M
Ultra High	\$5.1 M	\$14.2 M	\$32.4 M

If PRODUCT/ SERVICE Improved

(Increase Repeat Rate & Number of Repeats by 30% and Revenue Per Purchase 20%)

Sales & Marketing Support Level	Conservative 80% odds of selling	Most Likely 50% odds of selling	Aggressive 20% odds of selling
Ultra Low	\$0	\$7,700	\$82,000
Low Support	\$97,000	\$340,000	\$1.0 M
Medium Support	\$810,000	\$2.4 M	\$6.8 M
High Support	\$2.2 M	\$6.6 M	\$17.4 M
Ultra High	\$4.0 M	\$12.6 M	\$35.0 M

If MARKETING CONCEPT and PRODUCT/ SERVICE Improved

(Increase Concept +20 Points, Repeat Rate & Number of repeats by 30% and Revenue per purchase 20%)

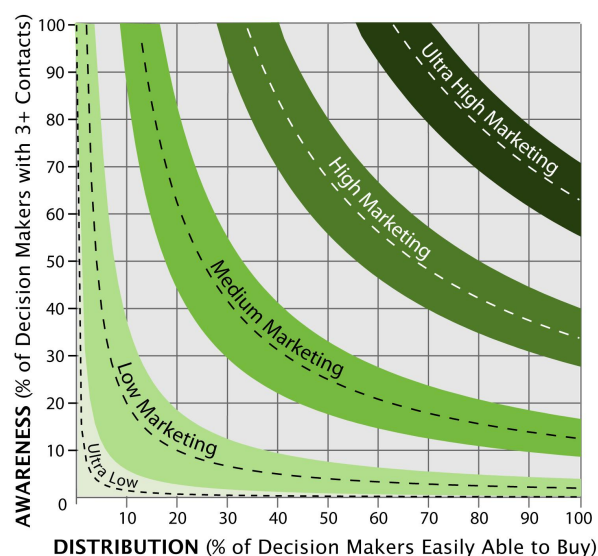
Sales & Marketing Support Level	Conservative 80% odds of selling	Most Likely 50% odds of selling	Aggressive 20% odds of selling
Ultra Low	\$0	\$13,000	\$140,000
Low Support	\$170,000	\$580,000	\$1.8 M
Medium Support	\$1.4 M	\$4.1 M	\$11.2 M
High Support	\$3.8 M	\$11.0 M	\$29.8 M
Ultra High	\$7.3 M	\$20.8 M	\$56.9 M

Additional Details

Fair Market Royalty (%)				
	Conservative - 80% Odds Royalty Percentage		Most Likely - 50% Odds Royalty Percentage	
At CURRENT State & Status	1.2%		1.6%	
Sales & Marketing Support Level	Annual Inventor Royalty Revenue			3 Year Value to Inventor If 50% Odds
	80% Odds	50% Odds	20% Odds	
Ultra Low Support	\$110	\$290	\$560	\$870
Low Support	\$1,800	\$4,300	\$7,600	\$13,000
Medium Support	\$13,000	\$29,000	\$50,000	\$87,000
High Support	\$35,000	\$78,000	\$130,000	\$230,000
Ultra High Support	\$65,000	\$150,000	\$250,000	\$440,000

Sales & Marketing Support Level Assumptions				
Sales & Marketing Support Level	Sample Numbers		% Aware x % Distribution (Aware & Able)	Inventor Estimate of Odds
	% Distribution	% Awareness		
Ultra Low Support (Word of Mouth)	5%	3%	0.2%	N/ A
Low Support (Small Company)	20%	10%	2%	N/ A
Medium Support (Medium Sized Company)	50%	25%	13%	N/ A
High Support (Large Company)	75%	45%	34%	N/ A
Ultra High Support (Mega or Niche)	90%	70%	63%	N/ A

Graph of EQUIVALENT (Awareness x Distribution) Combinations



NAICS Industry Codes For This Invention
33639 - Other Motor Vehicle Parts Manufacturing
33429 - Other Communications Equipment Manufacturing
33411 - Computer and Peripheral Equipment Manufacturing
33329 - Other Industrial Machinery Manufacturing

Patent Numbers that apply to this Product/ Service
12/036,729

Inventor(s) PEDIGREE	
Years EXPERIENCE in related industry	10
GRANTED Patents	0
Licensing Deals SIGNED	0
Innovations that have SHIPPED	0

For USA Patents: Utility Patent = 7 digit number, Design Patent starts with D, Planet Patent starts with PP. Provisional Application "61/ xxx,xxx", Non provisional application "12/ xxx,xxx", Design patent application "29/ xxx,xxx"

CAUTION: This Merwyn Business Simulation Research Report includes no warranty or guarantee. Results and opinions should be considered rough and directional in nature. This is because the report is based upon inventor- supplied data and simplified modeling methods. If you are looking to invest, distribute, purchase or become involved with this innovation, in any way, we strongly urge you to validate the inventor data and sales forecasts BEFORE committing yourself or your resources. Merwyn Research, Inc. shall not be responsible for any liability or damages arising out of the failure to perform such investigation and validation. Changes in the concept description, product, pricing, or input assumptions will almost certainly change results.

Additional Forecasts for Other Countries

Annual Sales - Probability Forecast - for Canada



Sales & Marketing Support Level	Conservative 80% odds of selling	Most Likely 50% odds of selling	Aggressive 20% odds of selling
Ultra Low	\$0	\$560	\$5,800
Low Support	\$7,400	\$24,000	\$68,000
Medium Support	\$63,000	\$180,000	\$420,000
High Support	\$170,000	\$490,000	\$1.2 M
Ultra High	\$320,000	\$910,000	\$2.1 M

Assumptions: exchange rate of \$1.00 US = \$1.01083 CAN; population of 33,390,141

Annual Sales - Probability Forecast - for United Kingdom



Sales & Marketing Support Level	Conservative 80% odds of selling	Most Likely 50% odds of selling	Aggressive 20% odds of selling
Ultra Low	£0	£510	£5,300
Low Support	£6,700	£22,000	£62,000
Medium Support	£57,000	£160,000	£380,000
High Support	£160,000	£440,000	£1.0 M
Ultra High	£290,000	£830,000	£1.9 M

Assumptions: exchange rate of \$1.00 US = £0.50458 UK; population of 60,776,238

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